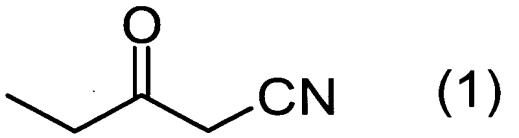
CLAIMS

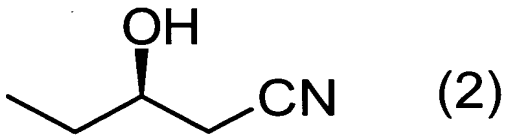
1. An acetoacetyl-CoA reductase having physicochemical properties shown in following (1) and (2) in which:

(1) the reductase acts, using NADPH or NADH as a coenzyme, on a 3-ketopentanenitrile represented by following formula (1):



(1)

to produce a (R)-3-hydroxypentanenitrile represented by following formula (2):



(2)

having an optical purity of 99%e.e. or more; and

(2) the reductase has a molecular weight of about 85,500 as determined by gel filtration analysis and about 26,000 as determined by SDS-polyacrylamide electrophoresis analysis.

2. The acetoacetyl-CoA reductase according to claim 1, further having physicochemical properties shown in following (3) to (5) in which:

(3) the reductase has an optimum temperature 27 to 33°C;

(4) the reductase has an optimum pH of 5.5 to 6.5; and

(5) the reductase is inhibited by p-chloromercuribenzoic acid, copper sulfate, silver nitrate, or mercury chloride as an inhibitor.

3. An acetoacetyl-CoA reductase which is a polypeptide described in following (a) or (b):

(a) a polypeptide consisting of an amino acid sequence represented by SEQ ID NO: 1 of the Sequence Listing; or

(b) a polypeptide which consists of the amino acid sequence resulting from addition, deletion or substitution of one or more amino acid residues in the amino acid sequence represented by SEQ ID NO: 1 of the Sequence Listing and has the activity of acting on a 3-ketopentanenitrile to produce a (R)-3-hydroxypentanenitrile having an optical purity of 99%e.e. or more.

4. The acetoacetyl-CoA reductase according to any one of claims 1 to 3 derived from a microorganism belonging to the genus *Achromobacter*.

5. The acetoacetyl-CoA reductase according to any one of claims 1 to 3 derived from a microorganism belonging to *Achromobacter xylosoxidans* subsp. *denitrificans*.

6. The acetoacetyl-CoA reductase according to any one of claims 1 to 3 derived from *Achromobacter xylosoxidans* subsp. *denitrificans* IFO15125 strain.

7. A DNA encoding the acetoacetyl-CoA reductase according to any one of claims 1 to 6.

8. A DNA consisting of a base sequence represented by SEQ ID NO: 2 of the Sequence Listing.

9. A recombinant vector comprising the DNA according to claim 7 or 8.

10. The recombinant vector according to claim 9 represented by pNTAX in Figure 2.

11. The recombinant vector according to claim 10 further comprising a DNA encoding a glucose dehydrogenase.

12. The recombinant vector according to claim 11, wherein the glucose dehydrogenase is derived from *Bacillus megaterium*.

13. A transformant obtained by transforming a host cell using the recombinant vector according to any one of claims 9 to 12.

14. A transformant obtained by transforming a host cell using a first recombinant vector comprising the DNA according to claim 7 or 8 and a second recombinant vector comprising a DNA encoding a glucose hydrogenase.

15. The transformant according to claim 14, wherein the first recombinant vector is pNTAX and the glucose hydrogenase is derived from *Bacillus megaterium*.

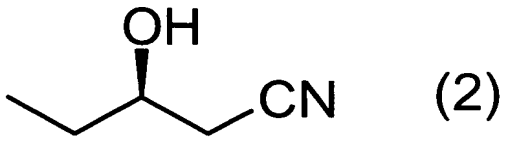
16. The transformant according to claim 14, wherein the first recombinant vector is pNTAX and the second recombinant vector is a recombinant vector represented by pSTVG in Figure 2.

17. The transformant according to any one of claims 13 to 16 wherein the host cell is *Escherichia coli*.

18. The transformant according to claim 17, wherein the transformant is *E.coli* HB101 (pNTAX) (FERM BP-10126).

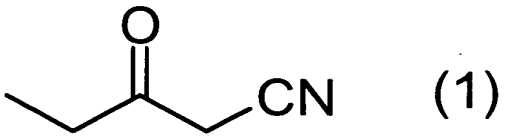
19. The transformant according to claim 17, wherein the transformant is *E.coli* HB101 (pNTAX, pSTVG) (FERM P-19567).

20. A process for producing a (R)-3-hydroxypentanenitrile represented by following formula (2):



(2)

the process comprising allowing an acetoacetyl-CoA reductase to act on a 3-ketopentanenitrile represented by following formula (1):



(1)

21. The production process according to claim 20 wherein the resultant (R)-3-hydroxypentanenitrile has an optical purity of 95%e.e. or more.

22. A process for producing an (R)-3-hydroxybutanoic ester represented by following formula (4):

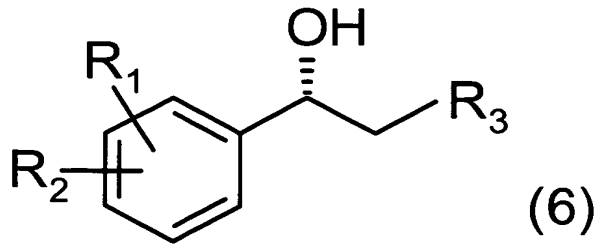
(4)

wherein R is a lower alkyl group which may be optionally substituted or branched , the process comprising allowing an acetoacetyl-CoA reductase to act on an acetoacetic ester represented by following formula (3):

(3)

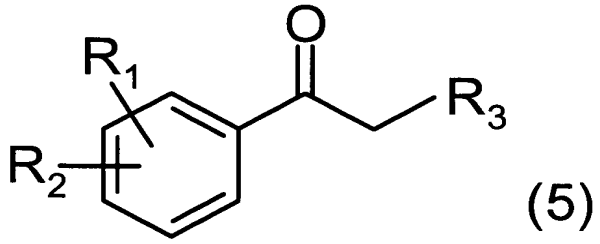
wherein R is the same as defined above.

23. A process for producing an optically active 1-phenylethanol derivative represented by following formula (6):



(6)

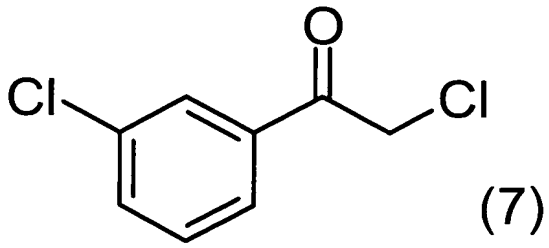
wherein R_1 and R_2 each represent a hydrogen atom, a halogen atom, an alkoxy group, or a nitro group, and may be the same or different respectively; and R_3 represents a hydrogen atom, a halogen atom, a hydroxyl group, or an alkyl group which may be optionally substituted, the process comprising allowing an acetoacetyl-CoA reductase to act on an 1-phenylethanone derivative represented by following formula (5):



(5)

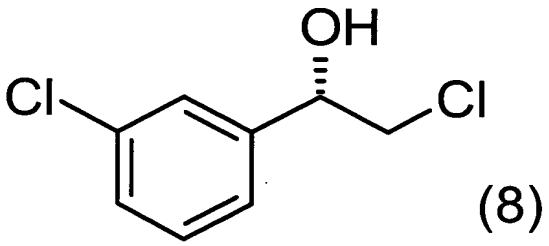
wherein R_1, R_2, and R_3 are each the same as defined above.

24. The production process according to claim 23, wherein the acetoacetyl-CoA reductase is allowed to act on 2-chloro-1-(3'-chlorophenyl)ethanone represented by following formula (7):



(7)

to produce (R)-2-chloro-1-(3'-chlorophenyl)ethanol represented by following formula (8):



(8)

25. The production process according to any one of claims 20 to 24, wherein the acetoacetyl-CoA reductase is derived from a microorganism belonging to *Achromobacter*, *Acinetobacter*, *Ralstonia*, *Alcaligenes*, *Azospirillum*, *Azotobacter*, *Bacillus*, *Chromatium*, *Ectothiorhodospira*, *Lupinus*, *Methylobacterium*, *Paracoccus*, *Rhizobium*, *Rhodococcus*, *Synechococcus*, *Syntrophomonas*, *Thiocapsa*, or *Zoogloea*.

26. The production process according to any one of claims 20 to 24, wherein the acetoacetyl-CoA reductase according to any one of claims 1 to 6 is used.

27. The production process according to any one of claims 20 to 24, wherein the acetoacetyl-CoA reductase used is a culture product of the transformant according to any one of claims 13 to 19.

28. The production process according to any one of claims 20 to 24 wherein the acetoacetyl-CoA reductase used is a polypeptide described in any one of following (c) to (e):

(c) a polypeptide consisting of an amino acid sequence represented by SEQ ID NO: 3 of the Sequence Listing;

(d) a polypeptide consisting of the amino acid sequence resulting from addition, deletion or substitution of one or more amino acid residues in the amino acid sequence represented by SEQ ID NO: 3 of the Sequence Listing and having an activity of asymmetrically reducing a 3-ketopentanenitrile to produce a (R)-3-hydroxypentanenitrile having an optical purity of 95%e.e. or more; and

(e) a polypeptide encoded by a DNA hybridizing under stringent conditions to a DNA consisting of a base sequence complementary to a base sequence represented by SEQ ID NO: 4 of the Sequence Listing and having an activity of asymmetrically reducing a 3-ketopentanenitrile to produce a (R)-3-hydroxypentanenitrile having an optical purity of 95%e.e. or more.

29. The production process according to claim 28, wherein the acetoacetyl-CoA reductase is derived from a microorganism belonging to the genus *Ralstonia*.

30. The production process according to claim 28, wherein the acetoacetyl-CoA reductase is derived from a microorganism belonging to *Ralstonia eutoropha*.

31. The production process according to any one of claims 20 to 25, wherein a transformant expressing a glucose dehydrogenase is used in addition to the acetoacetyl-CoA reductase used in the production process according to any one of claims 28 to 30.

32. A recombinant vector comprising a DNA consisting of a base sequence represented by SEQ ID NO: 4 of the Sequence Listing and represented as pNTRE in Figure 3.

33. A transformant which is a recombinant *Escherichia coli*, *E.coli* HB101 (pNTRE) (FERM P-19566).

34. A transformant which is a recombinant *Escherichia coli*, *E.coli* HB101 (pNTRE, pSTVG) (FERM BP-10125).

35. The production process according to any one of claims 20 to 24 wherein the acetoacetyl-CoA reductase used is

a culture product of the transformant according to claim 33 or 34.